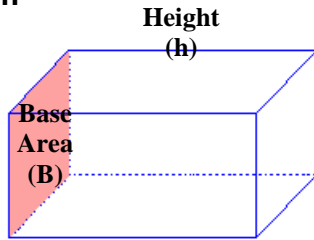


Volume of Prisms & Cylinder

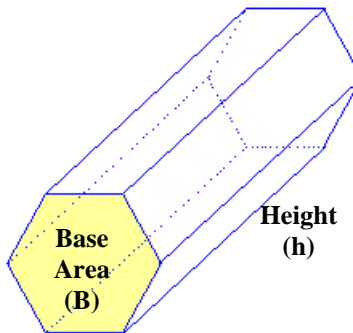
A **prism** is a 3D shape with two identical parallel bases (top and bottom are the same). All other faces are rectangles.

To find the volume of ANY prism, find the area of the base and multiply it by the height.

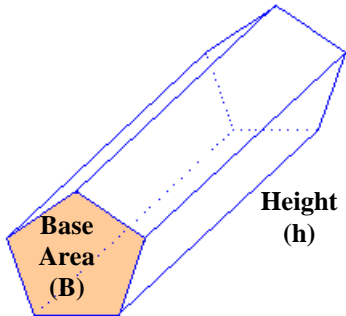
Any Prism



Rectangular prism



Hexagonal prism



Pentagonal prism

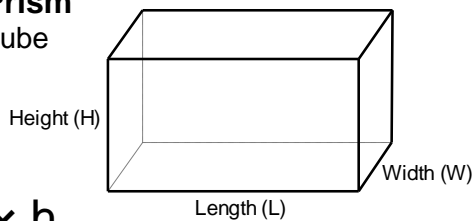
This formula is for
 ANY PRISM:

$$V = B \times h$$

*B is the area of the base
 (shaded region on the
 diagrams)*

Rectangular Prism

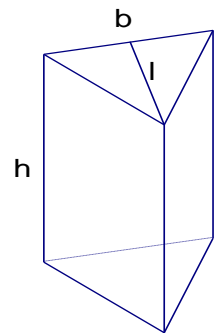
- also includes cube



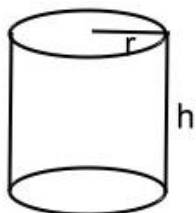
$$V = l \times w \times h$$

Triangular Prism

$$V = \frac{b \times l \times h}{2}$$



Cylinder – Basically, a circle-based prism



$$V = \pi r^2 h$$

Remember: $\pi = 3.14$ (or, there is a π button on your calculator)

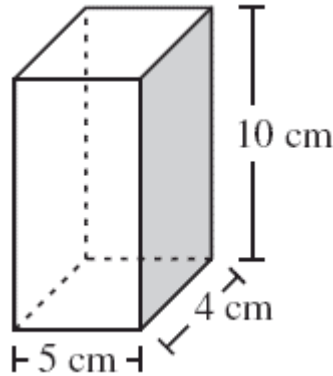
Example 1: Determine the volume of this prism

$$V = B \cdot h$$

$$= 5 \cdot 4 \cdot 10$$

$$= 200$$

\therefore The volume is 200 cm^3



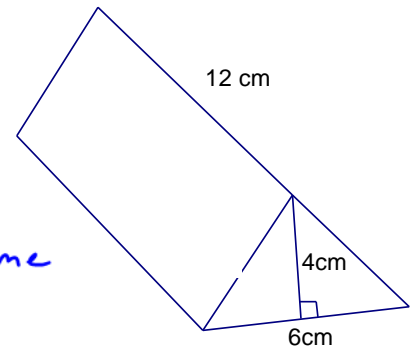
Example 2: Determine the volume of this prism in cm^3 .

$$V = B \cdot h$$

$$= \frac{6 \cdot 4^2}{2} \cdot 12$$

$$= 144$$

\therefore The volume is 144 cm^3



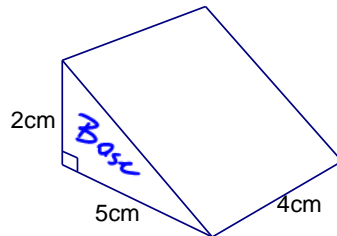
Example 3: Determine the volume of this prism in cm^3 .

$$V = B \cdot h$$

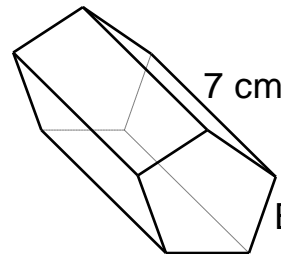
$$= \frac{5 \cdot 2}{2} \cdot 4$$

$$= 20$$

\therefore The volume is 20 cm^3



Example 4: Determine the volume of this prism in cm^3 .



Base Area = 8 cm^2

$$V = B \cdot h$$

$$= 8 \cdot 7$$

$$= 56$$

\therefore The volume is 56 cm^3

Example 5: Determine the volume of this cylinder in yd^3 .

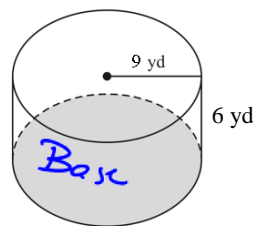
$$V = B \cdot h$$

$$= \pi r^2 \cdot h$$

$$= \pi (9)^2 \cdot 6$$

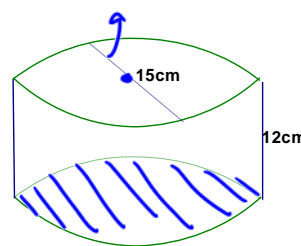
$$= 1526.81$$

\therefore The volume is 1526.81 yd^3



Example 6: Determine the volume of this cylinder in cm^3 .

$$r = \frac{15}{2} = 7.5$$



$$V = B \cdot h$$

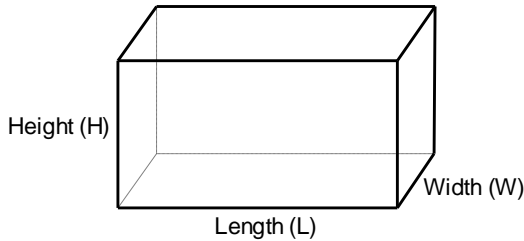
$$= \pi (7.5)^2 \cdot 12$$

$$= 2120.58$$

\therefore The volume is 2120.58 cm^3

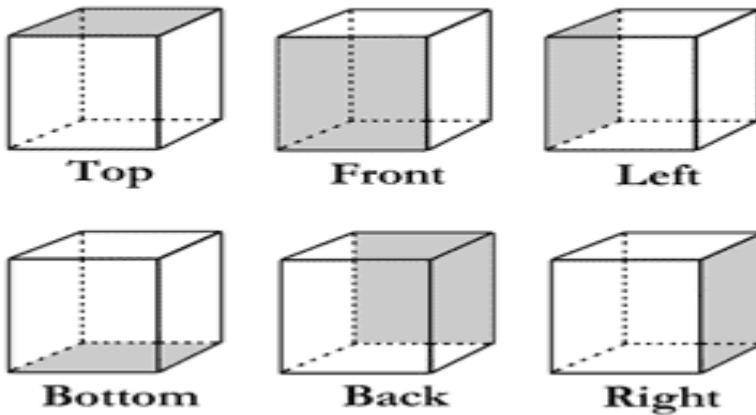
Surface Area of Prisms

Prism (Rectangular/Right)



Add the area of all the faces

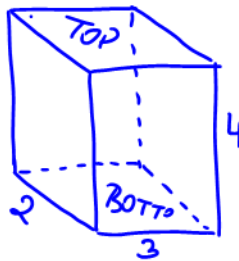
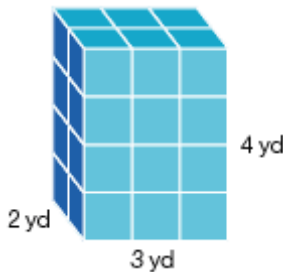
Surface Area of a Prism



$$A = 2(\text{top} + \text{front} + \text{side})$$

$$A = 2(lw + lh + wh)$$

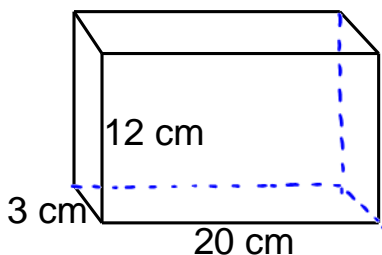
Example 1: Determine the surface area of this prism in yd^2 .



$$\begin{aligned} A &= 2(2 \cdot 3 + 3 \cdot 4 + 2 \cdot 4) \\ &= 2(6 + 12 + 8) \\ &= 2(26) \\ &= 52 \end{aligned}$$

\therefore The SA is 52 yd^2

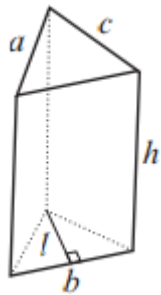
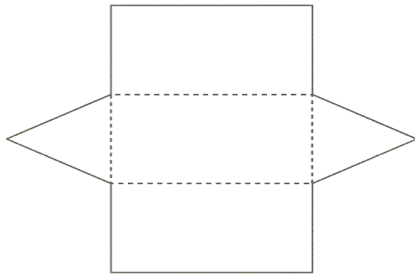
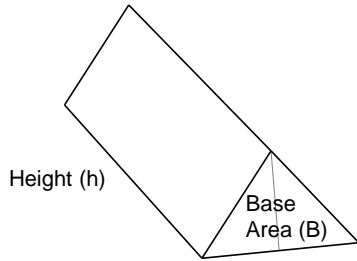
Example 2: Determine the surface area of this box which has **NO LID**.



$$\begin{aligned} SA &= 2(\text{front} + \text{side}) + \text{bottom} \\ &= 2(lh + wh) + lw \\ &= 2(20 \cdot 12 + 3 \cdot 12) + (20 \cdot 3) \\ &= 2(240 + 36) + 60 \\ &= 2(276) + 60 \\ &= 552 + 60 \end{aligned}$$

$SA = 612 \text{ cm}^2$

Any Other Prism (e.g. Triangular)



Add the area of all the faces

Each side will be a rectangle,
Use the Area of a Rectangle
formula: $A = L \times W$

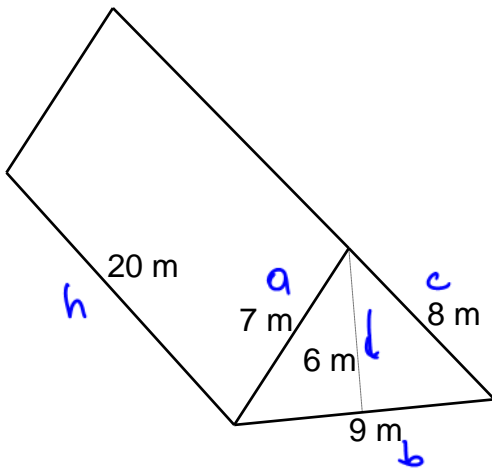
In this case, the Base of the
prism is a triangle. Use the Area
of a Triangle formula:

$$A = \frac{bh}{2}$$

If the Base is not a triangle, the
area of the base will be given.

$$A_{\text{total}} = A_{\text{rectangles}} + 2A_{\text{base}} \\ = ah + bh + ch + bl$$

Example 3: Determine the surface area of this prism in m^2 .

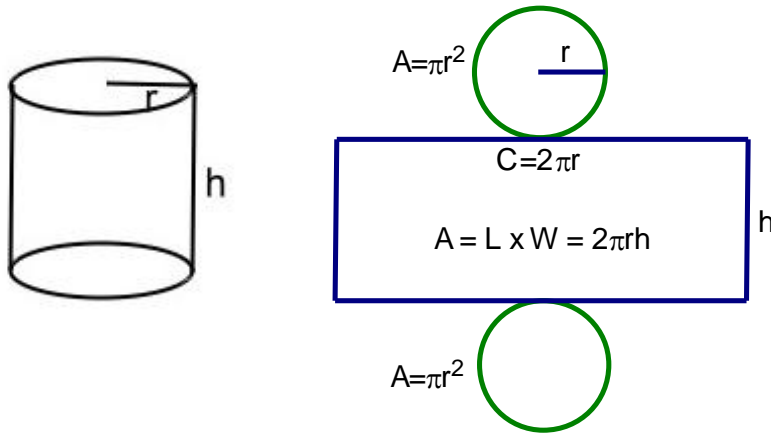


$$SA = ah + bh + ch + bl \\ = 7 \cdot 20 + 9 \cdot 20 + 8 \cdot 20 + 9 \cdot 6 \\ = 534$$

$$\therefore SA \text{ is } 534 \text{ m}^2$$

Surface Area of Cylinders

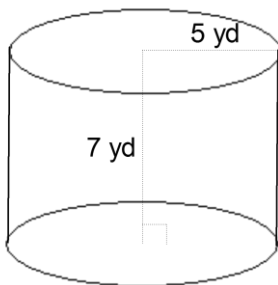
Cylinder (Basically – a Circle Based Prism)



$A = 2(\text{top}) + \text{side}$
 The top/bottom is a circle

$$A = 2(\pi r^2) + 2\pi r h$$

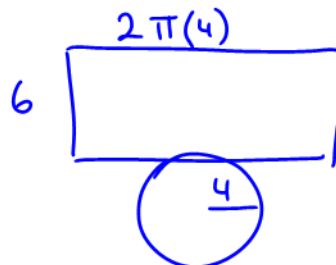
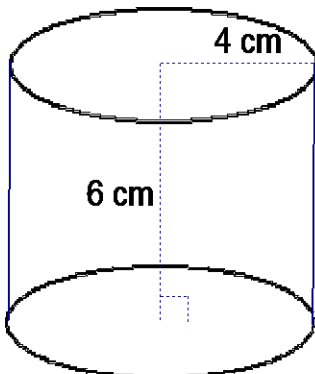
Example 1: Determine the surface area of this cylinder in yd^2 .



$$\begin{aligned} SA &= 2(\text{top}) + \text{side} \\ &= 2(\pi r^2) + 2\pi r h \\ &= 2(\pi 5^2) + 2\pi 5 \cdot 7 \\ &= 376.99 \end{aligned}$$

\therefore The SA is 376.99 yd^2

Example 2: Determine the surface area of this drinking glass.

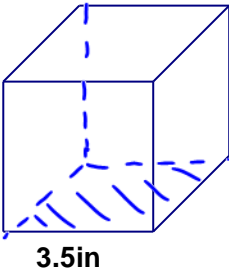
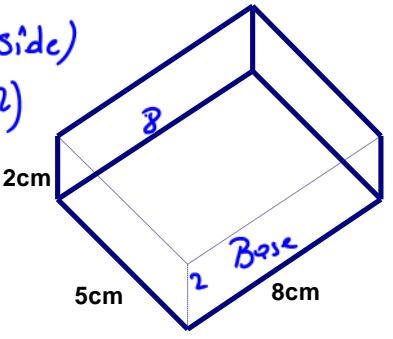
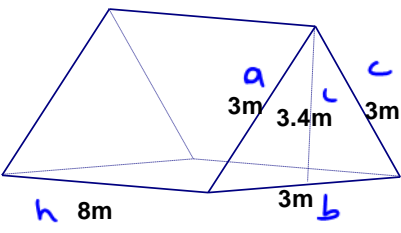
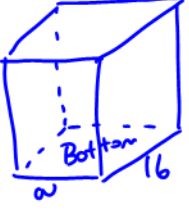
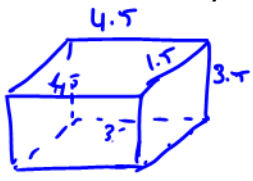

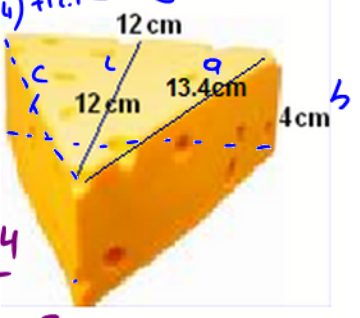


$$\begin{aligned} SA &= \text{bottom} + \text{side} \\ &= \pi(4)^2 + 2\pi(4)6 \\ &= 201.06 \end{aligned}$$

\therefore SA is 201.06 cm^2

Surface Area of Prisms - Practice

Find the surface area of the following shapes (round to 1d.p. where needed):

<p>a.</p> $SA = 6(3.5)^2$ $= 73.5 \text{ in}^2$ $V = B \cdot h$ $= (3.5)^2(3.5)$ $= 42.9 \text{ in}^3$ <div style="text-align: center;">  <p>3.5in</p> </div>	<p>b.</p> $SA = 2(\text{top} + \text{front} + \text{side})$ $= 2(8.2 + 8.5 + 5.2)$ $= 132 \text{ cm}^2$ $V = 5(8)(2)$ $= 80 \text{ cm}^3$ <div style="text-align: center;">  <p>2cm 5cm 8cm Base</p> </div>
<p>c.</p> <div style="text-align: center;">  <p>h 8m 3m 3.4m 3m a c b</p> </div> $SA = 3 \cdot 8 + 3 \cdot 8 + 3 \cdot 8 + 3 \cdot (3.4)$ $= 24 + 24 + 24 + 10.2$ $= 82.2 \text{ m}^2$ $V = B \cdot h = \frac{3(3.4)}{2} \cdot 8 = 40.8 \text{ m}^3$	<p>d. A rectangular prism has a length of 16m and a height of 12m. If the surface area of this prism is 664 m^2, determine the width. and volume</p> <div style="text-align: center;">  <p>12 16 w Bottom</p> </div> $SA = 2(\text{top} + \text{side} + \text{front})$ $664 = 2(16w + 16 \cdot 12 + 12 \cdot w)$ $664 = 2(28w + 192)$ $664 = 56w + 384$ $\frac{280}{56} = \frac{56w}{56}$ $\boxed{w = 5}$ $V = 16 \cdot 5 \cdot 12$ $= 960 \text{ m}^3$
<p>e. A toy chest is in the shape of a rectangular prism. Determine the surface area of the toy chest.</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;">  </div>  </div> $SA = 2(\text{bottom} + \text{front} + \text{side})$ $= 2(4.5 \times 1.5 + 4.5 \times 3.5 + 1.5 \times 3.5)$ $= 2(6.75 + 15.75 + 5.25)$ $= 2(27.75)$ $= 55.5 \text{ ft}^2$ $V = l \cdot w \cdot h$ $= 4.5 \times 1.5 \times 3.5$ $= 23.6 \text{ ft}^3$	<p>f. A piece of cheese is in the shape of an isosceles triangular prism. The cheese needs to be wrapped with saran wrap. Determine the surface area of the cheese to find out how much wrap would cover this cheese.</p> <div style="text-align: center;">  <p>12 cm 13.4 cm 4 cm b c</p> </div> $SA = (3.4)(4) + (13.4)(4) + 12(4) + 12 \cdot 12$ $= 53.6 + 53.4 + 48 + 144$ $= 299.2 \text{ cm}^2$ $V = \frac{b \cdot h}{2} \cdot l = \frac{12 \cdot 4}{2} \cdot 12$ $= 288 \text{ cm}^3$

ANSWERS: a. 73.5 in^2 , b. 132 cm^2 , c. 82.2 m^2 , d. 5m, e. ~~27.8 ft^2~~ , f. 299.2 cm^2

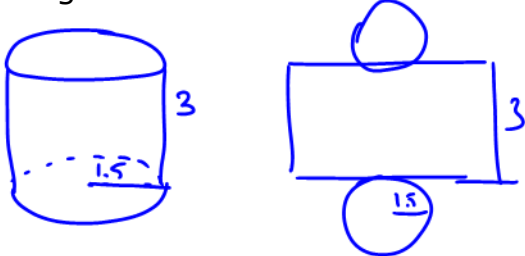
55.5 ft^2

$V = 42.9 \text{ in}^3$ $V = 80 \text{ cm}^3$ $V = 40.8 \text{ m}^3$ $V = 960 \text{ m}^3$ $V = 23.6 \text{ ft}^3$ $V = 288 \text{ cm}^3$

Surface Area of Cylinders – Practice

Find the surface area of the following shapes. Round answers to 1d.p. where necessary. Use 3.14 or the pi button for π .

a. Find the surface area of a cylinder with a height of 3m and a diameter of 3m



$$SA = 2 \text{ circles} + \text{rectangle}$$

$$= 2\pi(1.5)^2 + 2\pi(1.5)(3)$$

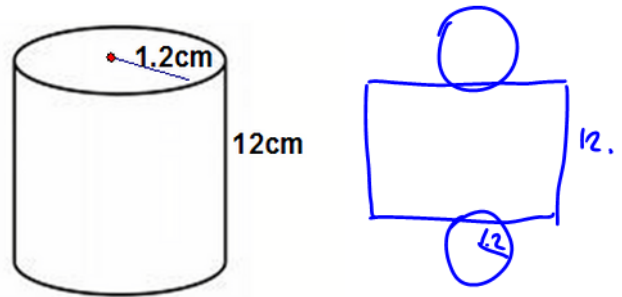
$$= 42.4\text{m}^2$$

$$V = \pi r^2 h$$

$$= \pi(1.5)^2(3)$$

$$= 21.2\text{m}^3$$

b.



$$SA = 2 \text{ circles} + \text{rectangle}$$

$$= 2\pi(1.2)^2 + 2\pi(1.2)12$$

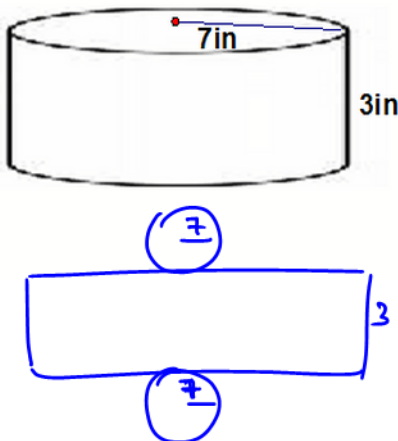
$$= 99.5\text{cm}^2$$

$$V = \pi r^2 h$$

$$= \pi(1.2)^2(12)$$

$$= 54.3\text{cm}^3$$

c.



$$SA = 2\pi(7)^2 + 2\pi(7)(3)$$

$$= 439.8\text{in}^2$$

$$V = \pi(7)^2(3) = 461.8\text{in}^3$$

d. If a cylinder has a surface area of 178.98cm^2 , and a radius of 3cm, determine the height of the cylinder.

$$SA = 2(\pi r^2) + 2\pi r h$$

$$178.98 = 2(\pi 3^2) + 2\pi(3)h$$

$$178.98 = 56.55 + 18.85h - 56.55$$

$$\frac{122.43}{18.85} = \frac{18.85h}{18.85}$$

$$h = 6.5$$

$$V = \pi r^2 h$$

$$= \pi(3)^2(6.5)$$

$$= 183.8\text{cm}^3$$

ANSWERS: a. 42.4m^2 , b. 99.5cm^2 , c. 439.6in^2 , d. $h=6.5\text{cm}$